SYSTEM AND METHOD FOR ROUTING CALLS TO MULTI-FUNCTION TELEPHONE NUMBERS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 60/174,429 filed January 4, 2000, whose entire contents are hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] *1. Field of the Invention:* The invention relates generally to telecommunications systems. Specifically, the invention relates to the use of a set of prefix characteristics and a multi-function telephone number to direct a call to communications devices assigned to that telephone number.

[0003] *2. General Background and State of the Art:* Existing telephone systems have become inundated with cellular telephones, pagers, facsimile machines, and other communications devices which have strained the availability of telephone numbers. To ease the strain, three digit area codes have been added based upon geographic location to increase availability. This has proved to be only a temporary solution, and has resulted in some cities having many different area codes, increasing the numbers that must be dialed when placing a call

[0004] Some prior art techniques have attempted to alleviate the problems of dwindling telephone number availability and the proliferation of area codes and also to make it easier to reach recipients by limiting the numbers that must be remembered and dialed. For example, one prior art technique disclosed in U.S. Patent No. 6,076,121 allows callers to dial preprogrammed codes and telephone number to reach a desired recipient or communications device. Each telephone number is assigned at least one functional property code that, when dialed along with the telephone number, directs the call to that telephone number. This allows one telephone number to be used multiple

times for many different communications devices. The recipient of a call, however, is responsible for assigning a functional property code to all of their telephone numbers; callers must then remember the functional property codes for each telephone number they wish to dial, which can vary widely not only for the telephone numbers of each recipient, but also from recipient to recipient. This technique, therefore, lacks a uniform standard that would make is easy for callers to remember a particular code, and creates the possibility of a caller having to dial a large, multi-digit functional property code before every telephone number.

[0005] Another prior art technique disclosed in U.S. Patent No. 5,465,295, allows a caller to dial a telephone number for a recipient followed by a coded suffix. This technique is used where a recipient has multiple telephones or communications devices, each having a different telephone number. The coded suffix directs the call to another one of the recipient's telephone numbers without having to remember the actual number for the particular telephone or communications device. Therefore, the caller does not need to remember or record every telephone number of a recipient; instead, the caller needs to dial only one number, followed by the appropriate coded suffix. This technique, however, does not solve the problem of limited availability of usable telephone numbers, since all communications devices of a recipient would be independently reachable by a separate telephone number.

[0006] The present invention addresses these problems with a simple, easy to use set of prefix characteristics that can be widely and uniformly applicable and that ease the strain created by the proliferation of communications devices and area codes. When combined with a telephone number, the set of prefix characteristics directs calls to communications devices, where multiple communications devices are assigned to common telephone numbers.

[0007] Accordingly, it is an object of the invention to provide a system and method of routing calls to communications devices using multi-function telephone numbers, where a potentially large number of communications devices are assigned to a common telephone number.

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[0009] It is also an object of the invention to reduce the number of telephone numbers by allocating one number to many different communications devices.

[0010] It is a further object of this invention to provide a way to reduce the number of area codes needed.

INVENTION SUMMARY

[0011] The invention provides a system and method of routing calls to communications devices using multi-function telephone numbers. The invention routes calls to specific communications devices assigned to a common telephone number by dialing a set of prefix characteristics followed by a telephone number. A central network identifies a call as being intended for a specific communications device based upon the set of prefix characteristics and routes the call to that device, provided that the specific communications device intended has been assigned to the telephone number.

[0012] The invention solves the problem of the proliferation of area codes and telephone numbers by allowing telephone numbers to be used for more than one communications device. A person having a voice line, a fax line, a cellular phone, a modem, a pager, or any other device requiring a telephone number may use one common telephone number for all of these devices. A caller wishing to contact this person on a specific one of his or her communications devices would dial the common telephone number, preceded by a short code designed to indicate to which of the communications devices the call is intended. Using this framework, a caller would only need to dial an area code when calling a different geographical location.

[0013] The present invention provides that any combination of prefix characteristics may be used to indicate a specific communications device. In one embodiment, a default number may be set as a number not requiring a set of prefix characteristics, and such a number can be directed to any communications device. For example, a regular

voice line phone may be set as a default line and would use the art currently existing. Additional line phones would then each be assigned a set of prefix characteristics. In another embodiment, a facsimile line may be dialed by first entering a set of prefix characteristics indicating a facsimile, for example the pound key (#). Another code may represent a wireless phone, for example the star key (*). Thus, on its most basic level, the present invention provides that the same 7-digit telephone number is the same telephone number for many different devices, but is actually at least an 8-digit telephone number. The following table illustrates an example of sets of prefix characteristics that can be used in the present invention:

	Local Calls	Long Distance Calls
Line	234-5678	1-xxx-234-5678
Facsimile	#-234-5678	1-xxx-#-234-5678
Wireless	*-234-5678	1-xxx-*-234-5678
Second Wireless	2*-234-5678	1-xxx-2*-234-5678
Third Wireless	3*-234-5678	1-xxx-3*-234-5678

[0014] The present invention therefore greatly reduces the array of 7-digit telephone numbers with which consumers must contend. For example, a family of four with six separate phone numbers (1 line, 1 fax, and 4 wireless) would have their array of numbers reduced to virtually one number. The same consolidation of telephone numbers would also be highly beneficial to businesses. For example, members of a group of limousine drivers, company vice presidents or real estate agents, etc. could each have the same 7-digit line number as part of their 9-digit telephone number. In various groups, number recall is essentially reduced to one digit as shown below. In the following table, note also that for long distance calls, the local call numbers are preceded by the appropriate area code (1-XXX) as in the above table. The area code may also follow the *.

Phone Type	Local Calls	Group 1	Group 2
Line	234-5678	Residence	Real Estate Office
Wireless	*-234-5678	Husband	Owner
2nd Wireless	2*-234-5678	Wife	Agent 1
3rd Wireless	3*-234-5678	Son	Agent 2
4th Wireless	4*-234-5678	Daughter	Agent 3

[0015] Additionally, the invention provides that different sets of prefix characteristics may be used, depending upon a variety of factors, such as market preference and infrastructure criteria for implementation. Using the above table, it is clear that a large number of additional lines and devices are able to be included for every telephone number, limited only by the number of available combinations of digits on a telephone keypad. The reduction in telephone numbers would also have the societal benefit of correcting other major problems. In addition to each telephone subscriber being potentially accessible by a multitude of communications devices through only one telephone number plus a set of prefix characteristics, much larger areas would be served by each area code, with the result that local calls would require only 7 digits and not 11 digits. Also, the availability of 8-digit cellular numbers will be greatly expanded by the inclusion of all existing 7-digit numbers. Additionally, number recall, dialing accuracy, number acquisition and accounting records would all reach greater levels of productive efficiency.

[0016] Each U.S. area code includes 792 assignable three-digit prefixes which produces 7.92 million phone numbers. These numbers presently serve line, fax, and wireless phones. By going to eight digits on fax and wireless, the present invention separates these groups so each has its own full complement of numbers. With each area code now dedicated to roughly 7.9 million line phone numbers, 75% of U.S. area codes can be eliminated and seven-digit line dialing maintained. In the case of wireless, the two-digit prefix (2* through 9*) would provide another 63 million wireless numbers per area code, etc. This is highly significant in view of the run-away growth of

wireless phones in the U.S. from 11 million (1992) to 86 million (1999). However, the invention makes it feasible for wireless phones to have two or more input lines, such as office and home numbers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a block diagram flowchart of the overall operation of a system implementing the present invention;

[0018] FIG. 2 is an overall schematic view of the system of the present invention, showing the components of a network implementing the present invention; and

[0019] FIG. 3 is a detailed view of the schematic components of FIG. 2, showing internal components of each major part of a network implementing the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0020] FIG. 1 is a block diagram flowchart of the overall operation of a system implementing the present invention. In block 10, a call is placed, such as for example from a wireless or cellular phone, facsimile machine, or line phone. In the present invention, the call will be placed by dialing the intended telephone number. The telephone number is preceded by a set of prefix characteristics that indicate a destination for each call. Each destination is a specific, intended communications device. A specific communications device may be a cellular or wireless telephone, a line telephone, a facsimile machine, a pager, or any other device now known or developed in the future which may be capable of receiving a call over a public telephone network. This specification intends that the terms wireless and cellular can be used interchangeably to refer to any telephone which communicates by transmitting and receiving signals using radio waves and other wireless forms of communication.

[0021] In one embodiment, the initial prefix characteristic is a C (or 2) for cellular or an F (or 3) for facsimile, followed by the telephone number. In another embodiment, a double-digit prefix is entered prior to the telephone number. For example, a caller can

dial I# (or 4#) for Internet, P# (or 7#) for pager, S# (or 7#) for satellite, and W# (or 9#) for wireless. In yet another embodiment, the two-digit prefix can include two non-numeral characters, such as for example ** or #*.

[0022] Telephone keypads may also be modified to allow different symbols to appear on the keypad. Each touch-tone digit is a unique combination of two single-frequency tones. The frequencies are arranged in a matrix. As the button is pushed for a specific digit, the appropriate combination of two tones is generated, corresponding to the intersection of the vertical and horizontal axes. The frequencies corresponding to the horizontal axis are called low band and are 697 Hz, 770 Hz, 852 Hz, and 941 Hz. The frequencies corresponding to the vertical axis are called high band and are 1209 Hz, 1336 Hz, 1477 Hz, and 1633 Hz. When a button is pushed, two tones at the frequencies corresponding to the intersection of the vertical and horizontal axes are produced. A central processing network or mobile switching center senses the frequencies of the tones and determines the dialed digit. For example, if the digit 8 were pushed, two frequencies would generated simultaneously and filtered and detected to determine the dialed digit.

[0023] However, there are four frequencies for the vertical axis and only three columns of digits on standard telephone keypads. Therefore, there are four available buttons on every keypad that are not used or provided for. Accordingly, four more symbols may be placed on each keypad. In the present invention, these symbols could be used as prefix characteristics to indicate an intended communications device. For example, Greek letters may be used as buttons on a keypad, such as φ, λ, π or ψ. These could therefore be used to create set of prefix characteristics where φ represents a wireless phone, λ represents a facsimile machine, π represents a pager, and ψ represents a line phone.

[0024] Each keypad digit is also expressed as a so-called BCD (binary coded decimal) four-bit code. The * is equivalent to a binary 1011, which is a decimal eleven (11), and the # is equivalent to a binary 1100, which is a decimal twelve (12). Also available are three unused BCD (binary coded decimal) four-bit codes that represent each digit. These are binary 1010 (ten), 1101 (thirteen), and 1110 (fourteen). Another row of three or more new symbols may be provided on new phones or with an inline attachment on present phones. Each symbol may designate a specific function like fax, wireless,

Internet, pager, etc. and may be utilized in the same manner as the * for wireless that was previously described.

[0025] Block 12 of FIG. 1 shows the procession of a call made from a wireless phone. If the call placed in block 10 is made using a cellular telephone, the call is routed through a local network for processing. Current wireless networks include a base station, or cell site, and a mobile switching center.

[0026] Wireless phone refers to any cellular or portable telephone that transmits on radio waves to a nearby wireless network and then over a standard telephone network to a line telephone or to a cellular tower and back to a nearby cellular or other portable telephone. This includes wireless telephones that transmit and receive on high frequency bands, as well as cellular systems that transmit via community radar sites or a satellite or other means instead of a local cellular tower. The term wireless phone will be used in this specification to refer to any wireless device, including a cellular telephone or other portable telephone. Line phone will be used in this specification to refer to any telephone using standard telephone lines to transmit and receive telephone calls.

[0027] The system and method of the present invention is compatible with the existing wireless infrastructure. Each wireless telephone has a 10-digit number called a Mobile Identification Number (MIN). To receive calls, the telephone searches for its MIN on a paging channel, and to transmit calls, the telephone transmits its MIN. The present invention can be integrated into the current wireless system in several ways. For example, the 10-digit MIN can be extended one or more digits. For incoming wireless calls using a one-digit set of prefix characteristics, the present 10-digit MIN can be used, with the mobile switching center ignoring the set of prefix characteristics and completing the call by paging with the present 10-digit MIN. In this example, the operation of the wireless system proceeds as normal. However, for incoming calls with the 2 or more digit set of prefix characteristics, one digit may be added to the MIN, or in the alternative, a two-step paging process may use the 10-digit MIN. This update may be required only on wireless phones that feature multiple customers sharing numbers one digit apart. In another example, for calls routed through the Public Switches Telephone Network (PSTN), the same switching presently used by the PSTN to route the 10-digit

wireless telephone number is utilized. In a further example, for the 11-digit version of the single-digit set of prefix characteristics, the routing may be processed by tone signaling, which is presently used for control and status indications. The unique tone of a key, for example the * key, which is made by combining the frequencies of 941 Hz and 1209 Hz, acts as a call signal denoting a wireless number.

[0028] Calls passing through the wireless network that are determined to be long distance, i.e. to an area code outside of the regional location of the caller, are routed to a central processing network in block 14 and then to a central processing network in the geographic area where the call is intended to go to, as shown in block 16. Here, a signal processor and central processing unit determine whether the call is intended for a wireless phone, or another type of device. If the call is intended for a wireless phone, the call is then routed to the wireless network in the same geographic area, the wireless network including the base station and the mobile switching center. This is shown in block 24. At this point, because of the prefix characteristic dialed preceding the telephone number, it has been determined that the intended communications device is a wireless phone. Accordingly, the call is then routed to the appropriate wireless phone. This is shown in block 30. If the call is intended for a line phone, the call is routed to the specific communications device as shown in block 26.

[0029] Calls passing through the wireless network that are determined to be intended for other wireless phones proceed through the base station and mobile switching center. Calls that are intended for local wireless phones are routed to the intended wireless phone as shown in block 20. Calls that are intended for out of the region are routed to another wireless network in the appropriate region as shown in block 22 and then routed to the intended wireless phone in block 28.

[0030] Calls may be placed from a wireless phone and intended for another wireless phone without the need for a set of prefix characteristics, as long as the intended telephone number has no other communications devices assigned to it, or as long as the intended telephone number has the a wireless phone as a default device.

[0031] If the call placed in block 10 is made from a line telephone using customary telephone lines, the call proceeds to the local central processing network as shown in

block 14. If the call is intended for a geographic area outside of the local calling area, it is routed to a central processing network in the intended area as shown in block 16. The central processing network is a Public Switched Telephone Network (PSTN) typically used in the telecommunications field for managing telephone call volume. If it is a local call, the central processing network performs call identification and routing functions. The central processing network includes a signal processor and a switching matrix to identify and route calls. The signal processor includes a microprocessor that receives a signal containing the call through an input. The signal processor reads the prefix characteristics at the beginning of the call to determine the intended communications device. Software at the signal processor determines the intended destination and outputs the call to a switch processor and then to the switching matrix, which routes the call to the appropriate location. This location may be either a specific communications device or another central processing network. The central processing network then routes the call to the intended communications device as shown in block 18.

[0032] FIG. 2 is a block diagram of a telecommunications network incorporating the present invention. Telephone calls placed from a wireless phone 10 travel over a wireless connection to a base station 12. The call is transferred to a mobile switching center (MSC) 14. If the call is intended for another wireless phone, it is either directly routed to the intended wireless phone 24, or it is routed to another mobile switching center 14 and then on to the intended wireless phone.

[0033] A wireless phone 10 communicates by radio signals directly or via satellite with a base station 12 within its area. The base station 12 converts incoming audio from the MSC 14 into RF (radio frequency) for transmitting to the wireless phone 10 and converts outgoing radio signals from the wireless phone 10 for transfer to the MSC 14 via a land line or microwave link. If the call is intended for another wireless phone 24, the MSC 14 routes the call to the destination wireless phone 24.

[0034] If the call is intended for another type of communications device, such as a line telephone 16, or for a wireless phone in a different regional location, the MSC 14 routes the call to a Public Switched Telephone Network (PSTN) 18 in the call area in which the original call is made. The PSTN 18 process the call and determines whether it is

intended for a locally-based device or a device in another geographic location. If intended for locally-based device, it is either routed to the appropriate device in the case of non-wireless calls, or to an additional MSC 20 for processing if the call is intended for a wireless phone 24. If the call is intended for a device, wireless or otherwise, in another geographic location, the call is routed to an additional PSTN 22. The additional PSTN 22 repeats the previous process, routing the call to a locally-based device, an MSC 20, or another PSTN 22 until the call reaches its intended destination.

[0035] FIG. 3 is a detailed view of the components of the system of FIG. 2. The baseband voice signal (analog or digital) of the wireless phone 10 is converted into RF signals for communication between the base station 12 and the wireless phone 10. This is accomplished at the base station 12, which includes a transceiver 28 having a transmitter 30, a receiver 32, and a scanning receiver 34.

[0036] FIG. 3 is a detailed view of the components of the system of FIG. 2. The baseband voice signal (analog or digital) of the wireless phone 10 is converted into RF signals for communication between the base station 12 and the wireless phone 10. This is accomplished at the base station 12, which includes a transceiver 28 having a transmitter 30, a receiver 32, and a scanning receiver 34.

[0037] The base station 12 also includes a system controller 36 that coordinates the operation of all base station equipment based on commands received from the MSC 14. The functions of the system controller 36 include control signal routing and message processing. The system controller 36 inserts control channel signaling messages, sets up voice channels, and operates the radio location/scanning receiver. In addition, the system controller 36 monitors equipment status and reports operational and failure status to the MSC 14.

[0038] The MSC 14 coordinates all communication channels and processes. The MSC 14 processes requests for service from wireless phones and land line callers, and routes calls between the base station 12 and the PSTN 18. The MSC 14 receives the dialed digits, creates and interprets call processing tones, and routes the call paths.

[0039] The MSC's main components are the system controller 36, communication controllers 38, a switching assembly 40, operator terminals 42, and subscriber database

registers 44. The system controller 36 guides the MSC 14 by coordinating the base stations, MSC switching functions, and PSTN connections. The system controller 36 creates and interprets commands between the MSC 14 and the base stations, controls the MSC switch, validates customers requesting access, maintains air time and PSTN billing records, and monitors for equipment failures. The communications controllers 40 process and buffer voice and data information between the MSC, base stations and PSTN. They combine voice paths with high-speed data and, in reverse, separate voice paths from high-speed data.

[0040] The switching assembly 40 connects base stations and the PSTN 18 with either a physical connection (analog) or a logic path (digital). Analog switches require a physical connection between switch paths. Current digital wireless switches use digital communication links. The switching assembly 40 is a high speed matrix memory storage and retrieval system that provides virtual connections between the base station voice channels and the PSTN voice channels. Operator terminals 42 control maintenance and administrative functions. An operator terminal 42 may be a computer monitor and keyboard dedicated to controlling equipment and modifying the subscriber database registers.

[0041] The system controller 36 processes various subscriber database registers 44, such as Authentication Center (AC), Home Location Register (HLR), Visitor Location Register (VLR), and Billing Center. The Authentication Center (AC) stores and processes information required to authenticate a wireless phone. During authentication, the AC processes information from the wireless phone and compares it to previously stored information. If the processed information matches, the wireless phone passes.

[0042] The Home Location Register (HLR) is a subscriber database register 44 containing each customer's Mobile Identification Number (MIN), which is the 10-digit phone number, and 11-digit Electronic Serial Number (ESN) of the wireless phone to uniquely identify each customer. Each wireless phone is created with a unique eleven-digit electronic serial number (ESN). The first three digits represent the manufacturer, and the last eight are a serial number. The combined MIN and ESN uniquely identify a valid subscriber. Each customer's user profile includes the selected long distance carrier, calling restrictions, service fee charge rates, and other selected network options.

The subscriber can change and store the changes for some feature options in the HLR (such as call forwarding). The system controller 36 uses this information to authorize system access and process individual call billing.

[0043] The HLR register is a set of bits of high-speed memory within a central processing unit. Instructions fetch the data to the register from a database in a magnetic hard disk memory. The subscriber database registers 44 are critical, so they are regularly backed up, typically on tape, to restore the information if the HLR system fails.

[0044] The Visitor Location Register (VLR) contains a subset of a subscriber's HLR information for use while roaming. The VLR eliminates the need for the visited MSC to continually check with the visitor's HLR each time access is attempted. The visitor's information is temporarily stored in the VLR memory, and then erased either when the wireless phone registers in another system or after a specified period of inactivity.

[0045] The base station 12 may command the wireless phone 10 to respond to commands (system orders) independent of the user's knowledge. This includes system registration commands. When the wireless phone receives an order, it will setup its response message (a flag) to indicate that it will access the system as a response to a system order.

[0046] The present system of sending line calls from a wireless phone 10 is not affected by the present invention. The originating wireless phone 10 dials the 7-digit or the 10-digit line number and the call is routed by the MSC 14 to the nearby PSTN 18 to the line phone 16 or through several PSTNs to a long distance line phone 16. The present invention also has no effect on line phone to line phone calls. All originating 7-digit and 10-digit calls from a line phone to another line phone would be routed in the present manner through the PSTNs.

[0047] When the call reaches the PSTN 18 in Figure 3, the set of prefix characteristics and telephone number are processed by a signal processor 46 which determines the communications device to which the call is intended. The call enters a central processing unit 48 in the signal processor 46. The signal processor may include a memory unit having database registers, such as a customer database, an 800 number

translation register, an area code routing register, and a DN-to-ILAN translation register. This register includes tables that translate Direct Number signals to Internal Line Appearance Number signals for processing telephone calls.

[0048] After a call having a set of prefix characteristics and a telephone number is processed by the central processing unit 48 and the signal processor 46, the call is sent through the central processing unit output port to a switching processor 50 and then to the switching matrix 52 after the call's destination is determined. The switching matrix 52 then routes the call to the particular component of the PSTN 18 that will transmit the call to the intended location. For example, if the set of prefix characteristics indicates that the call is intended for a local line telephone, the switching matrix 52 routes the call through a line connection to the intended device. If the set of prefix characteristics indicates that the call is intended for a local wireless phone, the switching matrix 52 routes the call to an MSC in the local area, which in turn identifies the intended unit and routes the call appropriately. If the set of prefix characteristics indicates that another type of communications device is intended, such as a pager, the switching matrix 52 also routes the call accordingly. Furthermore, if the set of prefix characteristics indicates that the call is intended for a communications device, wireless or otherwise, in another geographic location, the switching matrix 52 routes the call to another PSTN 22, where a signal processor having a central processing unit identifies the communications device intended using the set of prefix characteristics and instructs the switching matrix 52 to route the call accordingly.

[0049] It is to be understood that other embodiments may be utilized and structural and functional changes may be made without departing from the scope of the present invention. The foregoing description of the embodiments of the invention have been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Accordingly, many modifications and variations are possible in light of the above teaching. For example, the set of prefix characteristics may be a set of suffix characteristics dialed at the conclusion of a telephone number. In another example, the set of prefix characteristics dialed to indicate a particular communications device may include symbols not currently included on telephones but which are possible in light of the frequencies associated with

the telephone keypads. It is therefore intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.